



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/027,919	12/20/2001	Masaru Seita	51343	9973

21874 7590 02/17/2004

EDWARDS & ANGELL, LLP

P.O. BOX 55874

BOSTON, MA 02205

EXAMINER

WONG, EDNA

ART UNIT

PAPER NUMBER

1753

DATE MAILED: 02/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/027,919

Applicant(s)

SEITA ET AL.

Examiner

Edna Wong

Art Unit

1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 January 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) 1-3,5-7,10,11 and 13-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3,5-7,10,11 and 13-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

This is in response to the Amendment dated January 21, 2004. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 103

Plating Solution

I. Claims **1-3, 5, 13 and 15** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Eckles** (US Patent No. 4,384,930) in combination with **Okinaka et al.** (US Patent No. 4,469,564).

The rejection of claims 1-3, 5, 13 and 15 under 35 U.S.C. 103(a) as being unpatentable over Eckles in combination with Okinaka et al. is as applied in the Office Action dated October 21, 2003 and incorporated herein. The rejection has been maintained for the following reasons:

Applicants state that Eckles does not teach disclose or suggest brightening agents of the formula -X-S-Y- as required by the present claims. Accordingly, the Eckles patent neither teaches nor suggests the combination of Applicants' brightening agent with a thiol-reactive compound. In response, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5

USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the combination is in the knowledge generally available to one of ordinary skill in the art.

Eckles teaches that other additives can be included in the copper acid plating baths of his invention, such as brighteners, buffering agents, levelers, wetting agents, etc. which are intended to improve the performance or life of the bath, the quality of the metal deposit and/or to impart other beneficial effects (col. 3, lines 27-35; and col. 3, line 61 to col. 4, line 5).

Okinaka teaches adding polysulfide compounds into a copper acid plating bath to increase the ductility of the deposited copper (col. 6, lines 3-25).

Thus, one of ordinary skill in the art would have added a polysulfide compound to a copper acid plating bath to increase the ductility of the deposited copper. Although Okinaka does not teach that the polysulfide compounds are brightening agents, it has been held that a newly discovered use or function of components does not necessarily mean the system is unobvious since this use or function may be inherent in the prior art. *Ex parte Pfeiffer* 135 USPQ 31.

Furthermore, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Applicants state that since Eckles does not teach or suggest Applicants' brightening compounds, neither does Eckles teach or suggest the problems with such brightening compounds that are solved by Applicants' invention. In response, the problems with such brightening compounds that are solved by Applicants' invention does not distinguish the plating solution composition, and thus process, from the prior art.

Applicants state that Eckles neither teaches nor suggests the filling of vias in a substrate with copper. There is nothing in Eckles that teaches or suggests that Applicants' claimed plating solution would fill vias with copper without void formation. In response, the filling of vias in a substrate with copper and filling vias with copper without void formation do not distinguish the plating solution composition from the prior art.

Applicants state that the Okinaka patent neither teaches nor suggests the use of the polysulfide compounds as brightening agents. In response, the polysulfide compounds would have been performing as brightening agents because it has been held that a newly discovered use or function of components does not necessarily mean the system is unobvious since this use or function may be inherent in the prior art. *Ex parte Pfeiffer* 135 USPQ 31.

Applicants state that the Okinaka patent fails to recognize the problem of the

Art Unit: 1753

formation of $-X-S^-$ compounds resulting from the use of the polysulfide compounds as brightening agents. In response, failing to recognize the problem of the formation of $-X-S^-$ compounds resulting from the use of the polysulfide compounds as brightening agents does not distinguish the plating solution composition, and thus process, from the prior art.

Applicants state that the Okinaka patent neither discloses nor suggests the use of thiol-reactive compounds, such as aldehydes, in copper electroplating baths. In response, the rejection is not overcome by pointing out that one reference does not contain a particular limitation when reliance for that teaching is on another reference. *In re Lyons* 150 USPQ 741 (CCPA 1966). Moreover, it is well settled that one cannot show nonobviousness by attacking the references individually where, as here, the rejection is based on a combination of references. *In re Keller* 208 USPQ 871 (CCPA 1981); *In re Young* 159 USPQ 725 (CCPA 1968).

Applicants state that Okinaka fails to teach or suggest filling vias in a substrate with copper. In response, filling vias in a substrate with copper do not distinguish the plating solution composition, from the prior art.

Applicants state that neither reference alone or in combination teaches or suggests a plating solution containing a combination of a polysulfide compound and a

Art Unit: 1753

thiol-reactive compound, such as aldehyde, for filling vias without voids. In response, In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the combination is in the knowledge generally available to one of ordinary skill in the art.

Applicants state that nothing in either of these references recognizes that control of certain brightening agent cleavage products allows for copper filling of vias without void formation. In response, the controlling of certain brightening agent cleavage products allows for copper filling of vias without void formation do not distinguish the plating solution composition from the prior art; and has no claim basis in process claim 6.

II. Claim **14** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Eckles** (US Patent No. 4,384,930) in combination with **Okinaka et al.** (US Patent No. 4,469,564) as applied to claims 1-3, 5, 13 and 15 above, and further in view of **Uzoh et al.** (US Patent No. 6,355,153).

Art Unit: 1753

The rejection of claim 14 under 35 U.S.C. 103(a) as being unpatentable over Eckles in combination with Okinaka et al. as applied to claims 1-3, 5, 13 and 15 above, and further in view of Uzoh et al. is as applied in the Office Action dated October 21, 2003 and incorporated herein. The rejection has been maintained for the following reasons:

Applicants state that nothing in Uzoh teaches or suggests the use of a thiol-reactive compound in the plating bath. In response, the rejection is not overcome by pointing out that one reference does not contain a particular limitation when reliance for that teaching is on another reference. *In re Lyons* 150 USPQ 741 (CCPA 1966). Moreover, it is well settled that one cannot show nonobviousness by attacking the references individually where, as here, the rejection is based on a combination of references. *In re Keller* 208 USPQ 871 (CCPA 1981); *In re Young* 159 USPQ 725 (CCPA 1968).

Applicants state that nothing in this patent teaches or suggests the combination of a thiol-reactive compound with a compound of the formula $-X-S-Y-$. In response, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958

Art Unit: 1753

F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the combination is in the knowledge generally available to one of ordinary skill in the art.

Applicants state that Uzoh neither teaches nor suggests the reduction of problems in via-filling using a copper plating bath containing a brightening agent of the formula –X-Y-S- by the addition of a thiol-reactive compound to the copper plating bath to control brightening agent cleavage products. In response, the reduction of problems in via-filling using a copper plating bath containing a brightening agent of the formula –X-Y-S- by the addition of a thiol-reactive compound to the copper plating bath to control brightening agent cleavage products do not distinguish the plating solution composition or process steps from the prior art.

Applicants state that if one were to combine Uzoh with a combination of Okinaka and Eckles, one would at best have a plating bath containing the surfactant of Eckles, the polysulfide compound of Okinaka and the metal oxidizing agent of Uzoh. In response, the disclosure of reference must be considered for what it fairly teaches one of ordinary skill in the art, pertinence of non-preferred disclosure must be reviewed in such light. *In re Meinhardt* 157 USPQ 270; and MPEP § 2123.

Process

III. Claims **6-8, 16 and 18** are rejected under 35 U.S.C. 103(a) as being

unpatentable over **Eckles** (US Patent No. 4,384,930) in combination with **Okinaka et al.** (US Patent No. 4,469,564).

With respect to claim 8, the rejection under 35 U.S.C. 103(a) as being unpatentable over Eckles in combination with Okinaka et al. has been withdrawn in view of Applicants' amendment. Claim 8 has been cancelled.

With respect to claims 6-7, 16 and 18, the rejection under 35 U.S.C. 103(a) as being unpatentable over Eckles in combination with Okinaka et al. is as applied in the Office Action dated October 21, 2003 and incorporated herein. The rejection has been maintained for the following reasons:

Applicants state that there is nothing in Eckles or Okinaka, either alone or in combination, that teaches or suggests that Applicants' claimed copper plating solutions and methods would provide for the filling of vias with copper without voids.

Applicants state that if one were to combined Eckles and Okinaka, one would not be lead to use any composition for filling of vias or that such vias could be filled without void formation.

In response, Eckles teaches that the ability of a plating bath to produce deposits relatively thicker in small recesses and relatively thinner on small protrusions thereby decreasing the depth of surface irregularities is known as "leveling" (col. 2, lines 53-56). Eckles teaches that levelers are included in the plating baths (col. 3, line 61 to col. 4, line 5).

Okinaka teaches copper electroplating a printed wiring board (col. 2, lines 13-16; and Fig. 1) and that a polyether is also used as a leveling agent that improves thickness uniformity particularly in circuit boards with holes (col. 6, lines 26-28).

Thus, the copper plating solutions and methods of Eckles and Okinaka would have been provided for the filling of vias with copper.

As to copper without voids, the Eckles and Okinaka combination appear to disclose a process at least in a similar manner as instantly claimed. There does not appear to be any method limitations set forth in the instant claims to distinguish the instant claims from the prior art. Therefore, it would have been within the skill of the art to expect that the process of the Eckles and Okinaka combination would have deposited copper without voids.

Applicants state that nothing in these patents teaches or suggest Applicants' method of filling vias comprising the step of controlling such cleavage products. In response, independent process claim 6 has no claim basis for controlling such cleavage products.

IV. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Eckles** (US Patent No. 4,384,930) in combination with **Okinaka et al.** (US Patent No. 4,469,564) as applied to claims 6-7, 16 and 18 above, and further in view of **Uzoh et al.** (US Patent No. 6,355,153).

The rejection of claim 17 under 35 U.S.C. 103(a) as being unpatentable over Eckles in combination with Okinaka et al. as applied to claims 6-7, 16 and 18 above, and further in view of Uzoh et al. is as applied in the Office Action dated October 21, 2003 and incorporated herein. The rejection has been maintained for the following reasons:

Applicants state that nothing in any of these references alone or in combination teaches or suggests filling vias in a substrate with copper using Applicants' claimed plating solution, and in particular that such vias can be filled without voids. In response, Eckles teaches that the ability of a plating bath to produce deposits relatively thicker in small recesses and relatively thinner on small protrusions thereby decreasing the depth of surface irregularities is known as "leveling" (col. 2, lines 53-56). Eckles teaches that levelers are included in the plating baths (col. 3, line 61 to col. 4, line 5).

Okinaka teaches copper electroplating a printed wiring board (col. 2, lines 13-16; and Fig. 1) and that a polyether is also used as a leveling agent that improves thickness uniformity particularly in circuit boards with holes (col. 6, lines 26-28).

Thus, the copper plating solutions and methods of Eckles and Okinaka would have been provided for the filling of vias with copper.

As to copper without voids, the Eckles and Okinaka combination appear to disclose a process at least in a similar manner as instantly claimed. There does not appear to be any method limitations set forth in the instant claims to distinguish the instant claims from the prior art. Therefore, it would have been within the skill of the art

Art Unit: 1753

to expect that the process of the Eckles and Okinaka combination would have deposited copper without voids.

V. Claims **10-11 and 19** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Eckles** (US Patent No. 4,384,930) in combination with **Okinaka et al.** (US Patent No. 4,469,564).

The rejection of claims 10-11 and 19 under 35 U.S.C. 103(a) as being unpatentable over Eckles in combination with Okinaka et al. has been withdrawn in view of Applicants' remarks.

Response to Amendment

Specification

The disclosure is objected to because of the following informalities:

page 21, line 1, there is no "Fig. 1".

page 21, line 14, there is no "Fig. 2".

Appropriate correction is required.

Claim Objections

Claim **10** is objected to because of the following informalities:

Art Unit: 1753

Claim 10

line 14, the word "comprising" should be deleted. The word "comprising" is already used in claim 10, line 2, to introduce the method steps.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

Claims **1-3, 5-7, 10-11 and 13-20** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1

line 10, the alternative expression of the Markush group is improper. MPEP 2173.05(h). The word "and" should amended to the word -- or --.

line 13, the alternative expression of the Markush group is improper. MPEP 2173.05(h). The word "and" should amended to the word -- or --.

Claim 2

line 18, the alternative expression of the Markush group is improper. MPEP 2173.05(h). The word "and" (first occurrence) should amended to the word -- or --.

Art Unit: 1753

line 19, the alternative expression of the Markush group is improper. MPEP 2173.05(h). The word "and" should amended to the word -- or --.

Claim 10

line 6, the alternative expression of the Markush group is improper. MPEP 2173.05(h). The word "and" should amended to the word -- or --.

line 10, the alternative expression of the Markush group is improper. MPEP 2173.05(h). The word "and" should amended to the word -- or --.

line 13, the alternative expression of the Markush group is improper. MPEP 2173.05(h). The word "and" should amended to the word -- or --.

Claim 11

line 18, the alternative expression of the Markush group is improper. MPEP 2173.05(h). The word "and" (first occurrence) should amended to the word -- or --.

line 19, the alternative expression of the Markush group is improper. MPEP 2173.05(h). The word "and" should amended to the word -- or --.

Art Unit: 1753

Claim 13

line 3, the alternative expression of the Markush group is improper. MPEP 2173.05(h). The word "and" should amended to the word -- or --.

Claim 14

line 3, the alternative expression of the Markush group is improper. MPEP 2173.05(h). The word "and" should amended to the word -- or --.

Claim 16

line 3, the alternative expression of the Markush group is improper. MPEP 2173.05(h). The word "and" should amended to the word -- or --.

Claim 17

line 3, the alternative expression of the Markush group is improper. MPEP 2173.05(h). The word "and" should amended to the word -- or --.

Claim 19

line 3, the alternative expression of the Markush group is improper. MPEP 2173.05(h). The word "and" should amended to the word -- or --.

Claim Rejections - 35 USC § 103

Claims 6-7, 16, 18 and **20** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Eckles** (US Patent No. 4,384,930) in combination with **Okinaka et al.** (US Patent No. 4,469,564).

The rejection of claims 6-8, 16 and 18 under 35 U.S.C. 103(a) as being unpatentable over Eckles in combination with Okinaka et al. is as applied in the Office Action dated October 21, 2003 and incorporated herein.

Eckles does not teach wherein the vias are filled without voids.

However, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the process of Eckles with wherein the vias are filled without voids because Eckles teaches that the ability of a plating bath to produce deposits relatively thicker in small recesses and relatively thinner on small protrusions thereby decreasing the depth of surface irregularities is known as "leveling" (col. 2, lines 53-56). Eckles teaches that levelers are included in the plating baths (col. 3, line 61 to col. 4, line 5).

Okinaka teaches copper electroplating a printed wiring board (col. 2, lines 13-16; and Fig. 1) and that a polyether is also used as a leveling agent that improves thickness uniformity particularly in circuit boards with holes (col. 6, lines 26-28).

Thus, the copper plating solutions and methods of Eckles and Okinaka would

have been provided for the filling of vias with copper.

As to copper without voids, the Eckles and Okinaka combination appear to disclose a process at least in a similar manner as instantly claimed. There does not appear to be any method limitations set forth in the instant claims to distinguish the instant claims from the prior art. Therefore, it would have been within the skill of the art to expect that the process of the Eckles and Okinaka combination would have deposited copper without voids.

Allowable Subject Matter

The following is a statement of reasons for the indication of allowable subject matter:

Claims **10-11 and 19** define over the prior art of record because the prior art does not teach or suggest a method for filling vias in a substrate with copper comprising the steps of controlling, adding and maintaining as presently claimed, esp., the step of maintaining a concentration of a compound having $-X-S^-$ structure equal or less than 1.0 micro mol/L.

The prior art does not contain any language that teaches or suggests the above. Therefore, a person skilled in the art would not have been motivated to adopt the above conditions, and a prima facie case of obviousness cannot be established.

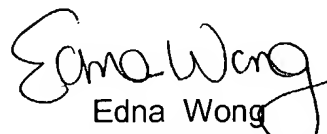
Claims 10-11 and 19 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action.

Art Unit: 1753

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Edna Wong whose telephone number is (571) 272-1349. The examiner can normally be reached on Mon-Fri 7:30 am to 5:00 pm, alt. Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Edna Wong
Primary Examiner
Art Unit 1753

EW
February 7, 2004